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fertilization, the reduction bringing about a return to the ancestral number of chromosomes.

Spindle formation.—Nemec's recent investigations led him to believe that in vegetative cells the spindle is bipolar from the start, while in spore-mother cells it is at first multipolar. The author objects to this distinction because he thinks that the two forms intergrade. In root tips of *Ephedra major* he finds that in the early prophase of division a layer of delicate kinoplasm is formed about the nucleus, and that this layer soon collects at opposite poles of the nucleus, where it appears as a pair of caps, the filamentous nature of which is easily recognized. As the nuclear membrane disappears, threads grow into the cavity, some of them becoming fast to the chromosomes and others forming continuous threads from pole to pole. Since the threads have the same origin and same reaction to reagents, he does not approve the distinction into mantle fibers and central fibers.

Centrosomes.—The conclusion is reached that centrosomes are absent from the higher plants, although it is conceded that it would be unscientific to assert that their occurrence here is impossible. Strasburger is inclined, at present, to attribute to the kinoplasm of the higher plants all those functions which it elsewhere shares with the centrosome.

Cilia-forming organs.—The existence of blepharoplasts, which he characterizes as specialized masses of kinoplasm, should not be regarded as evidence in favor of a general occurrence of centrosomes among the higher plants. While acknowledging that it would be hard to doubt the centrosome nature of the organ which gives rise to the tail of the animal spermatozoon, he does not think it necessary to assume that the bodies at the base of cilia in animals are centrosomes. The evidence does not point to the existence of similar bodies at the base of the cilia of plant swarm spores and gametes.—CHARLES J. CHAMBERLAIN.

Classification of bacteria.

THE completion of Migula's great taxonomic treatise will be cordially welcomed by all bacteriologists. The first or "general" part which was reviewed in this journal² on its appearance some two years ago clearly foreshadowed the importance of the "special" part, and the huge volume of 1068 pages now before us³ does not disappoint the expectations that were then raised. Here are brought together some 1200 descriptions of bacterial species with a more or less complete bibliography of each form, and, what is perhaps more important than all else, with an orderly arrangement by means of which related forms may be readily traced. With all its obvious defects,

² BOT. GAZ. 24: 379. Nov. 1897.

³ MIGULA, W.: System der Bakterien. Handbuch der Morphologie, Entwicklungsgeschichte und Systematik der Bakterien. Zweiter Band. Spezielle Systematik der Bakterien. 8vo. pp. 1068. *pl.* 18. *figs.* 35. Jena: Gustav Fischer, 1900. *M* 30.

it remains true that Migula's system of classification is the best working classification now available, and the appearance of this comprehensive treatise based on his system is likely to facilitate its introduction.

In the preface, the author states that it was originally his intention to obtain cultures of all the bacteria described and to conduct extensive comparative investigations, but after nine years of labor, and with much personal sacrifice, only about half of the forms described were obtained. He somewhat naïvely continues: "Das Schlimmste war aber, dass von den ungefähr 600 Kulturen, die ich nach und nach bekommen hatte, nur ein kleiner Teil den Original-beschreibungen wirklich entsprach, die meisten Arten jedoch entweder falsch bestimmt waren, oder sich in langjähriger Kultur so in ihren kulturellen Eigenschaften verändert hatten, dass sie mit der ursprünglichen Beschreibung nicht in mindesten mehr übereinstimmten." The original plan was consequently abandoned and the description of each species is given as nearly as possible in the words of the original discoverer, even where there is reason to think that two writers have independently described one and the same microbe. It is but natural that there should be shrinking from the herculean task of welding together imperfect and incomplete descriptions, and it is perhaps more useful in the present state of investigation to possess in convenient form and in some one place all descriptions by all writers however variable they may be in accuracy and completeness. At the same time it is probable that a more ruthless hand than Professor Migula's would have eliminated some of the more obviously unfit descriptions that have been allowed to cumber his pages.

The colossal work that has been performed by Dr. Migula may be best appreciated when it is stated that descriptions of over 300 different kinds of spherical bacteria, over 700 rod-shaped bacteria and 96 spiral forms have been carefully transcribed, arranged and supplied with an excellent artificial key. If defects in manner and matter are found, they are due quite as much to the chaotic condition of systematic bacteriology as to lapses on the part of the author. Careful examination of portions of the text has failed to reveal any errors of great moment, although several faults of omission and commission have been noticed. Exception, for instance, may be taken to the statement on p. 393 regarding *B. Welchii* (*B. aerogenes capsulatus*) that the germs "seem to possess no pathogenic properties," a statement explained perhaps by the fact that no reference is given to the important study of this germ in volume I of the Journal of Experimental Medicine. We find also no notice of *B. pyogenes filiformis* (Flexner, Journ. Expt. Med. 2: 211), an organism that presents many points of interest to the systematist.

Among the more important omissions we have noticed are all the species of water bacteria described by two American writers, Wright (Memoirs National Academy of Sciences 7. 1895) and Ravenel (Memoirs National Academy of Sciences 8. 1896). However, only the continued practical use

of a text of this sort, in special investigations will show whether errors and omissions are sufficiently numerous to impair the value of a book that is certainly the fruit of monumental labor.—E. O. JORDAN.

A volume of Saccardo's *Sylloge*.

THE ACTIVITY of cryptogamic botanists is well shown by the recent issue of another volume supplementing Saccardo's great work enumerating all known fungi.⁴ The volume has been prepared with the assistance of Dr. P. Sydow, and contains descriptions of species of fungi published during the four years closing with 1898. It was at first thought that an annual supplementary reference list of new species, omitting descriptions, would sufficiently meet the needs of working botanists, and three such lists were published in *Hedwigia*. But the great number of species constantly appearing makes the desirability of a volume like the present one beyond all dispute.

The species issued during the period of four years attained very nearly the enormous number of five thousand. This brings the total number of species described in twelve volumes of the *Sylloge*, two additional volumes being devoted to indexes, up to 47,304.

Next to the convenience of possessing all specific and generic descriptions is that of good indexes, and in these the *Sylloge* is not wanting. The present volume is supplied with a full index of species and of hosts, together with one of the genera and higher divisions contained in all the fourteen volumes.

Much critical acumen has been shown in compiling the work, and many duplications of species or of names have been rectified. There also appear descriptions of twenty-nine species not before published.

A novel and interesting feature of the work is the tabulation for easy comparison of all the genera of the *Sylloge*, arranged according to the complexity of structure of the spores. This part occupies sixty-two pages.

Altogether the work is one of great value to the student of systematic mycology. So long as new species continue to be issued by the thousand yearly, botanists cannot be too grateful for helps of this kind.

The volumes may be obtained through book dealers, or by addressing the senior author at Padua, Italy.—J. C. A.

NOTES FOR STUDENTS.

PROFESSOR ROBERT A. HARPER⁵ has published the results of his researches on cell-division in sporangia. These investigations were a natural

⁴SACCARDO, P. A. and SYDOW, P.: *Sylloge fungorum omnium hucusque cognitorum digessit, P. A. Saccardo*; vol. XIV, supplementum universale Pars iv. Adjectus est index totius operis. 8vo. pp. 1316. Patavii, 1899. 83 francs.

⁵HARPER, ROBERT A.: Cell-division in Sporangia and Asci. *Annals of Bot.*, 13:467. 1899.